

REMARKS

These amendment and remarks are filed in response to the Office Action mailed October 19, 2007. For the following reasons, this application should be allowed and the application passed to issue. No new matter is introduced. The amendment to claim 1 is supported by the specification, including the Examples, as illustrated in Table 1.

Claims 1, 5, 7, 14, 16, 18, 20-22, 24, 26, 27, 29-32, and 36 are pending in this application. Claims 1, 5, 7, 14, 16-18, 20-22, 24, 26-32, and 36 were rejected. Claim 1 has been amended in this response. Claims 2-4, 6, 8-13, 15, 17, 19, 23, 25, 28, 33-35, and 37 were previously canceled.

Claim Rejections Under 35 U.S.C. § 103

Claims 1, 7, and 27-32 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. (US 2002/0034685) in view of Maeda et al. (US 2003/0113626) and Shinohara et al. (US 6,447,958). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is comparison between the invention as claimed and the cited prior art.

An aspect of the invention, per claim 1, is a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode. The porous film is adhered to a surface of at least one of the positive electrode and the negative electrode. The porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 4 parts by weight per 100 parts by weight of the filler. The resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin binder. The rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit. The other resin binder comprises at least one

selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone. The ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. %.

The Examiner asserted Sato et al. disclose a lithium ion battery with a porous film including an alumina filler and fluorine-based polymeric binder. The Examiner acknowledged that Sato et al. do not teach that the resin amount is 1.5 to 8 parts by weight per 100 parts by weight ceramic powder, but rather teach that the filler amount ranges from 5 to 100 parts by weight per 100 parts by weight of the polymer. The Examiner further recognized that Sato et al. do not teach that the binder comprises core-shell type rubber particles comprising acrylonitrile, acrylate, or methacrylate units. The Examiner averred that Shinohara et al. disclose a separator including 1 to 95% ceramic powder.

The prior art references do not suggest the claimed lithium ion secondary battery. The resin binder content of the porous film is 1.5 to 4 parts by weight. According to Shinohara et al. the smallest possible amount of binder is 5% by weight. Further, there is no suggestion or motivation to combine Maeda et al. with Sato et al. and Shinohara et al. Maeda describes a long “laundry list” of binders for use in battery electrodes, an active component of the battery. There is no suggestion to select the specifically claimed binders for use in a porous film, an inactive component of the battery. Furthermore, the claimed amount of the binder is much less than that disclosed by Sato et al. The porous film of Sato is mainly a polymer film with an added filler, whereas the claimed porous film is predominately the filler and a small amount of polymer binder to bind the filler. The effect of the amount of filler used by Sato et al. is completely different than that of the present claims, thus, it would have been further unobvious to combine the cited references as asserted by the Examiner.

In paragraph [0094] Sato et al. teach that the separator 3 is preferably configured as a “shutdown separator.” Thus, the porous film of Sato et al. is a conventional sheet-like separator. Sato et al. further teach that separator having no shutdown function can also be used in paragraph [0095]. Nonwoven fabrics are known sheet-like separators not having a shutdown function.

In addition to disclosing separators with binder concentrations outside the scope of the present claims, Shinohara et al. disclose the binder is nitrogen-containing aromatic polymer, which has greatly different physical properties than the binders according to the present invention.

The morphology of the separator of Sato et al. is very different from the binders of Maeda et al. and the amount of filler used in the prior art is very different from the present claims. Therefore, even if combined, the present invention can not be achieved.

In addition, as shown in Table 1 of the specification, too little binder causes peeling of the porous film (Com. 1a), too much binder provides unfavorable high rate characteristics, and no filler reaches an unfavorable highest temperature (higher than the melting point of lithium) (Com. 3a). Table 3 also shows that too little binder results in peeling (Com. 1b) and too much binder has unfavorable high rate characteristics (Com. 2b). Thus, the claimed combination of binders and percent composition is not obvious in view of the cited references.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Sato et al.,

Shinohara et al., and Maeda et al. to modify the battery of Sato et al. to provide a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode, wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 4 parts by weight per 100 parts by weight of the filler, the resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin binder, the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, the other resin binder comprises at least one selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone, and the ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. %, as required by claim 1, nor does common sense dictate the Examiner-asserted modification. The Examiner has not provided any evidence that there would be any obvious benefit in making the asserted modification of Sato et al. *See KSR Int'l Co. v. Teleflex, Inc.*, 500 U.S. ____ (No. 04-1350, April 30, 2007) at 20.

The mere fact that references can be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Applicants submit that Sato et al., Shinohara et al., and Maeda et al. do not suggest the arrangement of the porous film as alleged by the Examiner.

The only teaching of the claimed lithium ion secondary batteries wherein the porous film comprises a porous film interposed between the positive electrode and the negative electrode, wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 4 parts by weight per 100 parts by weight of the filler, the resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin

binder, the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, the other resin binder comprises at least one selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone, and the ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. % is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must not be based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claims 14 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. in view of Maeda et al. and Shinohara et al. and further in view of Murai et al. (US 2002/0048704). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Sato et al., Maeda et al., and Shinohara et al. did not teach a porous film and a separator. The Examiner relied on the Murai et al. teaching of a separator to assert that it would have been obvious to include a separator to increase insulation.

The combination of Sato et al., Maeda et al., and Murai et al., however, does not suggest the claimed lithium ion secondary battery because Murai et al. do not cure the deficiencies of Sato et al., Maeda et al., and Shinohara et al. Murai et al. do not suggest the resin binder comprising a plurality of resin binders including core-shell type rubber particles and other resin binder and the amount of resin binder, as required by claim 1.

Claims 5, 21, 22, and 24 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. in view of Maeda et al. and Shinohara et al. in view of Sheibley (US 4,371,596). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Sato et al., Maeda et al., and Shinohara et al. did not

teach a filler comprising a mixture of a large particle group and a smaller particle group. The Examiner relied on the Sheibley teaching of a separator comprising a filler material with two distinct particle sizes to assert it would have been obvious to use two distinct particle sizes for better packing and to vary the pore size. The Examiner averred that the combination of references would necessarily provide the claimed elongating percentage.

The combination of Sato et al., Maeda et al., Shinohara et al., and Sheibley does not suggest the claimed lithium ion battery, as Sheibley does not cure the deficiencies of Sato et al., Maeda et al., and Shinohara et al., as Sheibley does not suggest a resin binder including core-shell type rubber particles and the amount of binder. Additionally, Sheibley is directed to an aqueous electrolyte zinc anode based batteries, not non-aqueous electrolyte lithium ion batteries of the present application. As is noted in column 1, lines 16 to 22 in Sheibley, Sheibley relates to Ag-Zn and Ni-Zn alkaline batteries. These alkaline batteries have totally different characteristics from those of lithium ion secondary batteries, and the structure, charge and discharge voltage range, electrolyte composition, and electrode composition are totally different as well. There is no suggestion that better packing and varying pore sizes would lead to improvements in a lithium ion battery. In addition, the Examiner has no basis for asserting that the combination of references would necessarily provide the claimed elongating percentage. Therefore, one of skill in this art would not combine Sheibley and Sato et al., Maeda et al., and Shinohara et al. One of skill in the art of non-aqueous lithium ion secondary batteries would not look towards aqueous alkaline batteries to solve a problem with a non-aqueous lithium ion secondary battery.

Claim 26 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. in view of Maeda et al., Shinohara et al. in view of Sheibley and further in view of Murai et al. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Sato et al., Maeda et al., Shinohara et al., and Sheibley did not teach a porous film and a separator. The Examiner relied on the Murai et al. teaching of a separator to assert that it would have been obvious to include a separator to increase insulation.

Murai et al. do not cure the deficiencies Sato et al., Maeda et al., Shinohara et al., and Sheibley, as explained above.

Claims 16 and 18 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. in view of Maeda et al. and Shinohara et al. in view of Call et al. (US 2002/0136945). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Sato et al., Maeda et al., and Shinohara et al. did not teach the average pore size. The Examiner relied on Call et al. to assert that the claimed pore size would have been obvious to control the amount of electrolyte flowing through the separator.

Call et al. do not cure the deficiencies Sato et al., Maeda et al., and Shinohara et al., as Call et al. do not suggest regards independent claim 1. Call et al. do not suggest the resin binder comprising a plurality of resin binders including core-shell type rubber particles and other resin binder and the amount of resin binder, as required by claim 1.

Claim 20 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Sato et al. in view of Maeda et al. and Shinohara et al. in view of Call et al. and further in view of Murai et al. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Examiner acknowledged that Sato et al., Maeda et al., Shinohara et al., and Call et al. did not teach a porous film and a separator. The Examiner relied on the Murai et al. teaching of a separator to assert that it would have been obvious to include a separator to increase insulation.

Murai et al. do not cure the deficiencies Sato et al., Maeda et al., Shinohara et al., and Call et al., as discussed above.

The dependent claims are allowable for at least the same reasons as the respective independent claims from which they depend and further distinguish the claimed lithium ion secondary batteries. For example, there is no teaching in the cited references of the required concentration gradient of the resin binder, as required by claim 27. The Examiner has **no basis** for asserting that the amount of resin binder is necessarily smaller on one side versus the other side. As disclosed in the present specification (*see, e.g.*, Para. [0096] – [0109]), the amount of binder in any given portion of the porous film can depend on how the porous film is made. In addition, the cited combination of references do not suggest an average pore size of micropores in the porous film obtained by a bubble-point method is 0.02 to 0.09 μm , as required by claim 16; and an elongating percentage of the porous film is 15% or more, as required by claim 21; and the unexpected improvements, as shown in the data in the specification, obtained by the inventions according to dependent claims 16 and 21.

In light of the above Amendment and Remarks, this application should be allowed and the case passed to issue. If there are any questions regarding these remarks or the application in general, a telephone call to the undersigned would be appreciated to expedite prosecution of the application.

No.: 10/551,934

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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